# ORGAN

# Voicing and Tuning.

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# ORGAN VOICING

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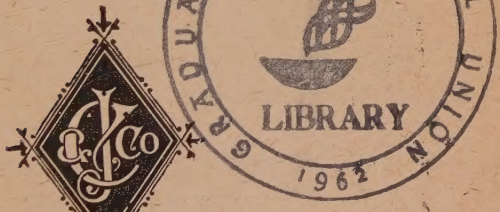
## A GUIDE TO AMATEURS



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# PREFACE.

Every organist should understand the mechanism of his instrument sufficiently well to be able to tune and regulate a note here and there. With this knowledge much trouble and annoyance may be avoided, and many small irregularities can be remedied at once, which otherwise might run on until some real injury to the instrument resulted. The inconvenience of a total lack of knowledge of organ construction is especially felt in small sized towns, because, if the expense incident to sending for a tuner and repairer is not an item for consideration, the delay often is. A little study of the mechanical parts of an organ is enough to fit an organist to set to rights all ordinary mishaps that may occur to the instrument under his control.

This little work was written by a practical organ-maker especially as a guide to amateurs, and to supply the information needed by organists. It describes clearly the best methods for voicing and tuning the various pipes; gives some useful hints in managing reed-stops; treats on organ instruction in brief; tools required for tuning; remarks on the materials used for pipes; in short all the instruction that one interested is likely to obtain from books will probably be found within the covers of this little guide.

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# PRACTICAL HINTS TO AMATEURS

ON

# ORGAN VOICING AND TUNING.

## CHAPTER I.

### ORGAN CONSTRUCTION.

FOR the benefit of those persons who may be desirous of becoming intimate with the musical branch of Organ building, and yet are unacquainted with its constructive features,

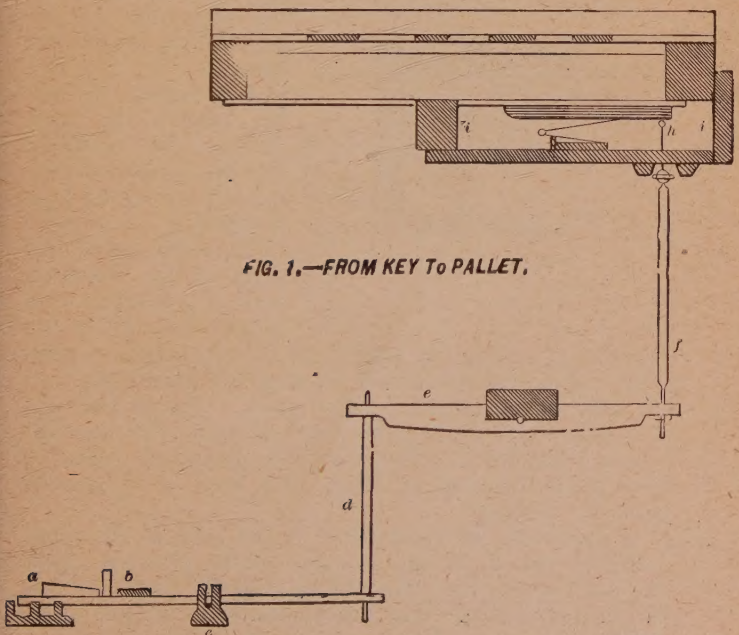



FIG. 1.—FROM KEY TO PALLET.

so much description will be given as may be considered to affect the production of sound.

*Fig.* 1 traces the mechanism from key to pallet. On depressing the key (*a*), which works on a pin inserted in the *pin-rail* (*c*), the *sticker* (*d*) raises one end of the *back-fall* (*e*), and pulls down the *tracker* (*f*), which brings with it the *pull-down wire* (*h*), that in its turn bringing down the pallet (*j*), to which it is fastened. The compressed air in the *wind-chest* (*i i*) then escapes through the vent made by the opening of the pallet; and, should the stop be drawn, ascends to the pipes. It remains to be explained that (*b*), the *thumping-board* or *damper*, assists to keep the keys level.

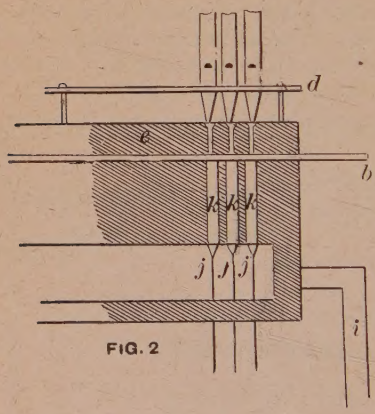


FIG. 2

In reference to *fig.* 2, which further elucidates *fig.* 1, when either pallet (*j j*), is pulled down by the depression of the key, the air ascends the *channels* (*k k k*), and passing through the *slide* (*b*), reaches the pipes above,— the *wind-chest* (*i*), the *rack-board* (*d*), through which the pipe feet pass.

Amateurs who contemplate the construction of an organ, are cautioned as to the importance of having the channels of the wind-chest of sufficient width, so that when all the stops are drawn, the tuning and the intonation remain intact. Instruments are met with which are tolerably well in tune until the full power is employed. They then become utterly offensive from an insufficiency of wind; this fault is technically termed "robbing."

It should also be noticed that if the holes in the upper board (*e*), *fig.* 2, for the reception of the pipe-feet, *pinch* the wind-supply, the pipes may be properly voiced, and yet fail in their places. Another hindrance to the free utter-

ance of pipes lies in over-crowding. Numerical strength is too often acquired at a great sacrifice of tone. This evil is too commonly underrated.

The form of the horizontal bellows is too well known to need any description here; reference, however, may be made to a rule, which will ensure a good supply of wind, other things being equal. For a Chamber Organ possessing, as it should, small scale stops suitably voiced and winded, two square feet for each stop is a fair approximation.

In reference to an unsteady supply of wind, some consider a capacious wind-trunk obviates the inconvenience; the writer, however, strongly recommends the introduction of a concussion bellows at some point between the bellows and the pipes, especially in Chamber Organs, where the wind-trunks are generally short.

## CHAPTER II.

### TOOLS FOR VOICING AND TUNING.

THEY are not numerous. Only those requisite for *flue* work will be mentioned; and, as many of them are simple in construction, suggestions will be offered for their home manufacture.

1.—The *notchers* of various sizes. Four will suffice; the diagram, *fig.* 3, gives a plan of each.

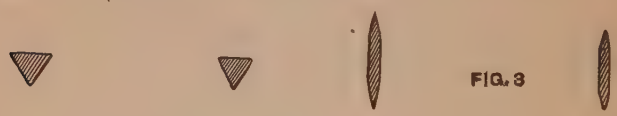


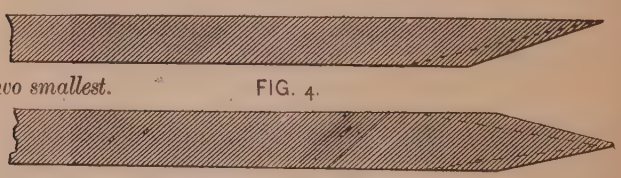
FIG. 3

The first two can be made from triangular files by grinding their terminals to agree with *fig.* 4; the triangular form, however, must not be destroyed. Finish on the oil-stone.

The latter two are adapted from as many blades of steel, $\frac{1}{2}$-in. wide, and to the thickness indicated in the *fig.* It will be seen that these two are double-edged.

*Fig.* 4 represents both kinds in elevation.

*Two largest.*



*Two smallest.* FIG. 4.

The dotted lines show the shape of the least in each case. The pointed terminals of the two least are knife-edged, and need to be finished on the oil-stone. These fixed into suitable handles complete the notchers.

2.—The "cutting up" knife, of the best steel. A large two-bladed knife will answer the purpose, by altering the shape of the smallest blade in accordance with *fig.* 5. In sharpening either blade, care must be taken to avoid *rounding* the surface; to this end, keep the blade flat on the stone.

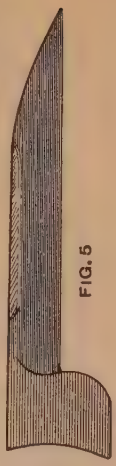


FIG. 5

3.—Four iron wires with diameters varying from $\frac{1}{4}$-in. to $\frac{1}{16}$-in. The lengths, from 1 ft. to 2 ft. All neatly rounded at their extremities.

4.—A large pair of scissors with cranked handles.

5.—*Cones*, made entirely of brass. Their forms are illustrated by *fig.* 6, together with a mop, about 1-ft. long, composed of wire and coarse thread. The cones are for tuning; the mop for silencing all the sounds of a given note in the mixture, or other compound stop, but the one about to be tuned.

Object (*a*), *fig.* 6, is a hollow cone, measuring 2-in. across its base, and 3-in. high. Object (*b*) is solid at the pointed end, and hollow at the opposite end, which should be 1 in. in diameter. The operator will consult his convenience by providing himself with another of the last, half the size. The mop (*c*) has already been described.

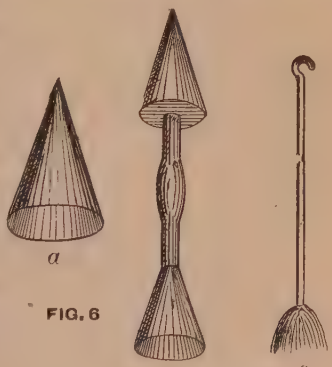


FIG. 6

6.—A *knocking-up cup*, similar in form to the cone (*a*), *fig.* 6, except at the point, for which is substituted a solid knob. It is of great substance, and, therefore, heavy, that it may the more readily effect its mission, namely, that of "knocking-up," or reducing the wind-hole of the pipe.

7.—*Files* of different kinds will be wanted for the stops of wood. Some should have their edges beveled, or knife-

edged, and serrated; others should be flat, and all of them varying in size from 6-in. to 1-ft. They should include coarse and fine cuts.

8. — Proportional compasses with sliding center, or "dividers" set to thirds, fourths and fifths, will be wanted when "cutting up" the mouths of the pipes.

9. — *Wind-gauge.* If one can not be borrowed for the purpose of correcting the wind-pressure, *fig. 7*, briefly described, may afford assistance in constructing one. A glass tube, of about 40-in. long and 1-in. inside diameter, is bent to the shape described by the unshaded channel traceable in the figure, commencing at (*a*), and terminating at (*b*). This fitted into a groove, made in the wooden frame surrounding the tube, can be made to stand erect in a sound-board hole (say mid. C), by the insertion of an ordinary wooden pipe foot (*c*), which, of course, will meet the glass tube. A little water being put into the tube at (*b*), and, with one exception, the wind-gauge is complete.

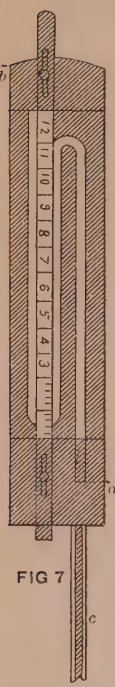


FIG 7

In order to correct the pressure, place the gauge in the above-named hole, and add a small quantity of iron or stone slabs to the surface of the bellows. On depressing the key, the water within the tube will be seen to fall on one side, and rise on the other; the difference between the two stationary surfaces of the water, measured by the *sliding* inch rule, forming part of, and passing out at either end of the wind-gauge, gives the pressure in inches.

The quantity of slabs can then be regulated until the required pressure is obtained.

## CHAPTER III.

### REMARKS ON THE MATERIALS USED FOR PIPES. PRESSURE AND PITCH.

THE metals used in the construction of Organ pipes are various. They include tin, $\frac{3}{4}$-tin, "spotted" metal, plain metal, type metal and zinc. The first approaches as near to purity as is possible, and has a beautiful silvery appearance. Both its beauty and its wear are of a lasting character, and it possesses the additional advantage of lightness, enabling it the better to support its own weight, and rendering it portable. When in use it imparts a somewhat reedy quality to the tone, and is, therefore, not unsuitable for reed stops, and those of the Gamba kind.

The second metal named ($\frac{3}{4}$-tin) has similar qualities to recommend it, but in a lesser degree, as it contains $\frac{1}{4}$-lead. It is not quite so expensive.

The third (spotted) takes its name from its mottled appearance, which indisputably proves the presence of tin; the extent of that presence, however, may vary from $\frac{1}{3}$ to $\frac{1}{2}$. The interstices between the spots are largest where the presence of tin is least, and they entirely disappear if the amount of tin is sufficiently increased. This metal possesses good "all round" qualities.

By the next (plain metal) is meant a composition of type (a combination of lead and antimony) and tin; the first largely predominating. Although receiving the most patronage of any, the average quality soon discolors and is heavy. It is, however, found to assist the "diapason" quality of tone, especially from about fiddle G upwards. Type metal is either too brittle for tuning purposes, or too heavy to support its own weight, according to the predominating ingredients.

The last-named metal (zinc) is frequently used for basses and "fronts," and if of good substance, and provided the speaking pipes are furnished with "metal" mouths, has much in its favor, being both portable and economical.

In use it is slightly wanting in the richness of tone peculiar to "metal."

The use of a superior metal in the trebles of all the metal stops is generally and justly considered to give additional brightness to the tone, and on that account commends itself for use in the upper portion of the stop.

For the wood pipes, well seasoned pine, free from knots, is commonly used. A wood pipe, on examination, will be found to have its block faced with mahogany, and its cap made partially or entirely of the same material. Mahogany alone is used when the instrument is intended for a hot climate.

Touching the manufacture of all pipes, it is of paramount importance to the voicer, that they should be thoroughly well made. For a pipe to speak readily and well, it is essential that its component parts be put together with particular accuracy. Attention to this one point will contribute largely towards a successful result, and agreeably lighten the task.

Before proceeding to the brief consideration of "pitch," it will be as well to dispose of the question affecting the wind-pressure. Having already given directions for its proper adjustment with the wind-gauge, we now recommend from 2-in. to $2\frac{1}{2}$-in. pressure as being sufficient for an organ intended for ordinary use.

The question of pitch, considered with reference to private use, is one of an arbitrary character. Several distinct pitches are in common use, varying between the two extremes, orchestral or concert, and the Parisian "normal pitch." The former will find acceptance with instrumentalists, and the latter with most vocalists, as being less distressing to the voice. The flatter pitch is certainly more desirable for instruments intended for either church or domestic use. There is nearly a semitone difference between the two pitches.

## CHAPTER IV.

### VOICING METAL WORK.—CHAMBER SCALES.

In offering the forthcoming hints, the writer is conscious of the inadequacy of written directions for meeting *every* contingency that may arise in the process of voicing, complex as it is. The operator, however, will save himself some trouble by invariably performing all operations with the greatest care; and, in the smaller scale stops, with absolute delicacy. A few false touches may render it necessary that the pipe should be taken to pieces and re-set.

It is, perhaps, needless to remind the amateur of the impossibility of his at once producing nicely finished stops, bringing, as he does, an untrained ear and hand to work requiring a protracted application for its proper accomplishment. A susceptible ear is not the creation of a day, nor can the faults in speech and tone be detected without some education of the auditory organ.

It is only fair to say that however implicitly the instructions here given may be carried out by those resolved on trying, the instructor would, without departing from his prescribed rules, probably produce a very different result, musically considered.

Assuming that an intimate knowledge of the structure of a metal pipe has accrued from an examination of its various parts, a few general directions in voicing may now be given.

The "notches," or "nicks," are those converging incisions on the front of the languid (a horizontal piece of metal placed at the top of the foot), which causes it to re-emble the edge of a saw. They are coarse, or fine, according to the character of the stop in hand. For example, the full-toned Open Diapason will receive a coarser notch than the delicate-toned Dulciana. The size of the wind-hole, and height of the mouth, also depend on this circumstance; and, in addition to this, the scale and pressure have to be taken into consideration. A slight increase

of power should be given to the treble of all stops, thus affecting a *crescéndo* from the bass upwards.

The following scales can be recommended for Chamber Organ use. The dimensions in all cases refer to the *diameters* of the pipes:—

Open Diapason (8-ft.)—8-ft. C, 5-in.; 4-ft. C, $2\frac{19}{12}$-in.; 2-ft. C, $1\frac{3}{8}$-in.; 1-ft. C, 1-in.; Top G, $\frac{9}{16}$-in.

Principal (4-ft.)—One note (semitone) less than Op. Dia. Top G, $\frac{5}{12}$-in.

Twelfth ($2\frac{2}{3}$-ft.)—One note less than corresponding length of pipe in Principal. Top G, $\frac{5}{16}$-in.

Fifteenth (2-ft.)—One note less than corresponding length of pipe in Twelfth. Top G, $\frac{1}{4}$-in.

Tierce ($1\frac{3}{5}$-ft.)—One note less than corresponding length of pipe in Fifteenth. Top G, $\frac{3}{16}$-in.

Scales for other stops will be given together with directions for voicing them; but before proceeding to give these directions, it is necessary to observe that they will be based upon the supposition that the *width of the mouth is invariably a quarter the circumference of the pipe*, and the wind-pressure is $2\frac{1}{2}$-in. *bare*.

Op. Diapason (8-ft.)—We select this stop first, because it makes the least demand upon delicacy of treatment; the Principal, however, will precede it in lodgment. The notch of the stop chosen is about $\frac{1}{10}$-in. deep at 8-ft. C, and the space between each about $\frac{1}{8}$-in.

At tenor C, this depth will have been gradually reduced to $\frac{1}{16}$-in., the intervening space almost disappearing. A very gradual diminution must now ensue, terminating in a notch, which, if submitted to a further and like reduction, extending over two more octaves, would present the faintest incision possible.

The use of the four notchers (*fig.* 3) must be divided over the whole stop, holding them like a pen in writing. The two smallest are double-edged for the purpose of making a corresponding, though much finer, notch in the lower lip running parallel with the languid. In using the two largest, the languid must first be incised, and afterwards the lower lip, finely, taking care to make the incisions opposite each other. Discontinue notching the *lip* in the upper octave of the mutation stops.

The *wind-way*, that space between the two parts notched, will probably want adjusting after the notching is done. This consists merely in making every part of the lower lip equidistant from the languid's edge.

The wind-hole must be corrected next. For the stop under consideration, the 8-ft. C should have a hole approaching $\frac{3}{4}$-in. in diameter; at tenor C, approaching $\frac{1}{2}$-in. A gradual reduction must then follow, terminating in $\frac{1}{8}$-in. This operation will be followed by that of cutting the mouth up.

The pipes, as they leave the hands of the maker, will be found to have their mouths lower than is necessary. Their proper adjustment with the "cutting up" knife (*fig.* 5) is a matter requiring caution. The unpracticed eye will need the assistance of a pair of proportional compasses, or common "dividers" for making the mouths the required height, which, in this stop, should be one-third the mouth's width, measured between the ears. The height is measured from the edge of the lower lip. Three or four pipes selected from various parts of the stop, and barely cut to this rule, will serve as guides for the eye in cutting the remainder. The blade of the knife must be held nearly horizontally.

Simultaneously with cutting up, the speech of each pipe should be tested, if not too unwieldly, by blowing into it in imitation, as nearly as possible, of the current of air supplied by the opening of the sound-board pallet. Before proceeding to the Principal, it may as well be remarked here, that, if desired, the lowest octave of the Open Diapason can be of stop'd wood pipes. These, of course, are much inferior to metal, but only require half the height required for metal pipes. The difference in cost is, of course, very considerable. They should be made to the following scale: C C, 4-in. × $3\frac{1}{4}$-in., and tenor C, $2\frac{5}{8}$-in. × $2\frac{1}{8}$-in. As directions for voicing wood pipes will form the subject of a future chapter, the height of the mouth will alone be indicated here. This should be $\frac{1}{3}$ of the mouth's width. The Open Diapason may now be placed on one side, and the Principal advanced to the same stage. The treatment will be almost identical with that applied to the former stop, recollecting that, as the

scale is somewhat smaller, the treatment will undergo a slight modification. The mouth, therefore, will be rather under $\frac{1}{3}$. Before placing this stop in the Organ, it is essential that every hole in the register should be proved to ascertain if any obstruction be offered to the wind. This should be done to every register *before* the rack-boards are laid. Being assured on this point, the Principal may occupy the place assigned for it, the two rows (presumably so arranged) standing back to back; but in all cases turning the mouths in the direction affording the most speaking room. If upon trial they are found to be tolerable in speech, and equal in loudness, leaving none subdued, they may be cut down nearly to pitch, in the following manner: Obtain a C tuning-fork to the required pitch, and cut "foot C" to it; upon cooling it will require cutting again; finally, leave it a trifle flat to the fork. From this one note the whole of the stop must be tuned; but this question being separately treated in another chapter, the reader is directed to it. Mention, however, may here be made of the requisite tools for this purpose, namely, the scissors for cutting down the lowest octave, the broad blade of the knife for the rest. Careful experiments with these tools will soon inform the operator to what extent he may safely shorten the pipe in the act of sharpening it. This being done throughout the stop, it must again be carefully gone through for the proper production of speech and tone.

This brings us to consider those faults most commonly met with under these circumstances, together with their remedies. They are:—*Slowness of speech.* Causes:—(*a*), languid too high; (*b*), upper lip too concave; (*c*), mouth over cut; (*d*), lower lip too convex. Remedies:—(*a*), lower by laying flat of chisel on languid, and gently tapping it with a hammer, or, if a small pipe, with manual pressure only; (*b*), raise with a suitable iron wire inserted at the top of pipe, or, if a lage pipe, with the hand; (*c*), in this case, pitch permitting, the body must be removed from the foot, and lowered as required, otherwise, a new body or pieced; (*d*), carefully depress lip with flat of chisel.

*Overblowing, or speaking the octave.* Causes:—(*a*), languid too low; (*b*), excessive wind-hole; (*c*), mouth too low; (*d*), upper lip too convex; (*e*), lower lip too concave.

Remedies:—(*a*), raise at the two corners with iron wire inserted at wind-hole; plant the wire a trifle below the notches; (*b*), if mouth high enough, reduce wind-hole with "knocking up" cup or chisel; (*c*), cut up cautiously; (*d*), depress with flat of chisel; (*e*), enlarge the flue by the insertion of a thin chisel, or a wire $\frac{1}{8}$-in. diameter beat out flat at one extremity, and turned over at a right-angle, makes a handy tool for effecting this remedy.

A *scraping* or *chiffing* noise is sometimes heard accompanying a note. To cure this, slightly increase the depth of the notch.

*Windiness.*—If the conveyances and wind-chest holes are sound, blame attaches solely to the pipe; it is generally a sign of bad making or indifferent voicing. Mention may be made of three things calculated to produce this defect: 1. Too deep a notch, especially that of the *lip*. 2. Mouth pulled about. 3. Pipe feet too short. Respecting this last, the 8-ft. C, and thereabouts, will sometimes suffer from windiness, if the feet are less than 12 inches long.

*Hollowness* of tone.—A desirable quality in some stops, but unhappily sometimes found in the Open Diapason. Wherever incongruously met with, it is generally the result of (*a*) overcutting; (*b*), upper lip too convex. Remedies for which, see (*c*), under "slowness of speech," and (*d*), under overblowing.

The following list of stops include all the most useful; the brief directions accompanying each are intended as supplementary to those already given. Note.—*Metal* stops only for the present alluded to.

Open Diapason and Principal.—These having been disposed of, we may proceed to the FIFTEENTH (2-ft.)—in treatment, very similar to Principal. The scale being slightly less, the height of the mouth will be proportionally less. It should be bright, but not screaming in tone. The mouths of the uppermost octave must be cut up (if required at all), cautiously, about $\frac{1}{4}$. The notching also of this portion must be extremely fine, if anything approaching clear intonation is to be obtained. The wind-hole at C C to be the same size as in the same length pipe in Principal.

TWELFTH ($2\frac{2}{3}$-ft.)—In treatment, similar to the last, but speaking a fifth to the Principal, its tone should be kept somewhat subdued. All stops speaking at any interval other than the octave, *super* or *sub*, come under this rule. This required modification will easily be obtained by keeping the wind-hole under, and the mouth commensurate. When cutting to pitch, the fifths should be left flat, as in the unison and octave stops; the interval will, of course, ultimately be tuned perfect. As some experience difficulty in hearing the fifth as the highest notes are approached, and consequently are liable to overcut, the exigency may be met by adjusting the lowest octave to the Principal first, dispensing with that stop afterwards, and proceeding in octaves with the rest.

The upper notes of this stop, the preceding one, and all mutation stops, have in common a tendency to shriek; an undesirable feature in any case. It may be obviated by raising the upper lip, inserting a suitable iron wire at the top of the pipe for the purpose.

MIXTURE or Compound Stop.—This comprises from three to seven ranks of pipes, and is similar to the Sesquialtera, but of higher pitch. The most ordinary three-rank mixture is that making the triad at intervals of a 17th, 19th and 22d from the Open Diapason. They are respectively at C C:—$1\frac{3}{5}$-ft., $1\frac{1}{3}$-ft., 1-ft., the first being a tierce, the second an octave-twelfth, and the third an octave-fifteenth. Commencing, as this stop does, with such small pipes, an unbroken series answering to the compass of the key-board becomes a practical impossibility, hence it is necessary to discontinue them in the treble, and substitute others an octave lower. This interruption is termed a "break," and is peculiar to most compound stops.

Regarding its scale, that given for the Tierce will also serve for the two remaining ranks; the gamut G serving for the C C of the second rank, and the tenor C serving for C C of the third rank.

The notching of this stop will be fine throughout, and its general treatment a modification of that applied to the Fifteenth. The first two ranks to be rather subdued in tone; the third rank stronger, equal, in fact, to the Fifteenth, to which, as before stated, it is an octave. The

extreme upper notes need ample wind-holes that they may equal in intensity those below.

Dulciana.—A delicate 8-ft. fine stop, requiring very careful treatment. Although the lowest octave is generally of stop'd wood pipes, we shall give the scale for the same in metal: 8-ft. C, $3\frac{5}{16}$-in.; 4-ft. C, 2-in.; 2-ft. C, $1\frac{1}{8}$-in.; 1-ft. C, $\frac{11}{16}$-in.; 6-in. C, $\frac{3}{8}$-in.

The notch throughout must be very fine, especially that of the lip. The flue, narrow. The mouth, hardly $\frac{1}{4}$ high, with a slight increase in the treble. The wind-hole at C C from $\frac{3}{16}$-in. to $\frac{1}{4}$-in. in diameter. At tenor C, $\frac{1}{5}$-in., and for the rest a gradual diminution ending in $\frac{1}{16}$-in. at the upper extreme. The upper lip must be beveled with a sharp knife to assist in thinning the tone.

The tendency to slowness in speech which characterises this stop can not altogether be overcome if its proper tone is to be preserved, nor is its removal absolutely needful, when we remember the almost exclusive suitability of the stop for *legato* music.

A "thin," soft and tranquil *timbre* should be aimed at, not excluding a little reediness, which may be induced by keeping the languid as high as is consistent with what readiness of utterance may be expected. Any convexity of the upper lip should be removed as being subversive to this end.

The most common faults are (*a*) slowness; (*b*), quivering or unsteadiness; (*c*), buzzing in coming on. Fault (*a*) is peculiar to stops of narrow measure, and to those required to be reedy; it is, however, augmented by overblowing. To cure, reduce the wind-hole if the languid is not low, nor the upper lip convex or high; (*b*), may be obviated by raising the languid, provided the wind supply is not too abundant; (*c*), resulting from too fine a notch, remedy by a slight increase in the depth of the incision, but this overdone will result in thickness and windiness of the tone.

Violin Diapason.—An 8-ft. stop, possessing much of the Open Diapason character, but rendered reedy (hence its name) by the addition of a slot in the cylinder. In scale, it is one note (semitone) less than the Open Diapason, and receives somewhat similar treatment in voicing, ex-

cepting the wind-hole, which will be less by a $\frac{1}{4}$, and the mouth a trifle lower in consequence; also the upper lip should be beveled like the Dulciana. Although a reedy stop, quickness of intonation is obtainable owing to the largeness of the scale, and should be insisted upon. When fairly voiced, the slotting may be commenced; previous to this process, however, a slight inclination to overblow is permitted, as each note is left about a semitone flat by the maker. The overblowing will almost or altogether disappear upon the pipe speaking its proper note. Previous to slotting, place the stop in the Organ, putting C ♯ in the C hole, D in the C ♯ hole, and so on throughout. Whilst in this *false* position, they should be cut to the Principal; the C can, of course, be cut to the B above, upon the pipes occupying their right holes.

The diameter of the cylinder measured down, and marked off from the top of the pipe, will give the highest point for the slot to commence; its width, at tenor C, should be $\frac{1}{2}$-in., and length from 2-in. to 3-in., whilst at the highest note, the width will be $\frac{1}{8}$-in., and length about $\frac{3}{4}$-in.; its length, however, must be "produced" until the proper pitch is acquired. The tongue resulting from the slot must not be detached from the pipe, but will serve for tuning purposes, the only means afforded in this stop for attaining that end. Further reference to this is made under "tuning." It is important that the tongue be no longer than is required, otherwise the intonation will suffer.

Viola di Gamba or Gamba, both 8-ft. stops, usually synonymous; the latter, however, is occasionally met with as a slight modification of the Violin Diapason, being similar to that stop in construction, but, from some difference in scale, wanting in richness.

*Fig.* 8 represents the Viola di Gamba in its English form, possessing the conical body, surmounted with a short inverted cone or "bell," as it is termed. In tone, it is of a soft reedy quality, and exceedingly beautiful. It rarely extends below tenor C. The dimensions at 2-ft. C are as under:

Body. { Length 21$\frac{3}{4}$-in. without the foot.
Largest diam. 1$\frac{3}{8}$-in.
Smallest do. $\frac{3}{4}$-in.

Bell. { Length $3\frac{3}{4}$-in.
Largest diam. $1\frac{1}{4}$-in.
Smallest do. $\frac{3}{4}$-in.

FIG. 8.

NOTE.—The length of the feet is, in all cases, omitted, as the *pitch* of the pipe is unaffected thereby.

It will be seen that the relative proportion of bell to body is as 1.6; this ratio is retained throughout the entire compass. In giving the above length for 2-ft. C, the flattest pitch in use has been taken into consideration.

Respecting voicing the stop, as it leaves the maker's hands, it will be found to have the bell and body detached, and in this state the whole stop must be fairly voiced independently of the bell. A little "overblowing" is permitted previous to the introduction of the bell, as in the Violin Diapason, before slotting. As the stop in question is one of delicate intonation, it calls for somewhat dainty treatment, hence notch finely, about the same as the Dulciana; cut the mouth tip hardly $\frac{1}{4}$, give a wind-hole $\frac{1}{8}$-in. diameter at 2-ft. C. The lip should be beveled and the flue narrow. Absolute promptness of speech must not be expected. Assuming that this stop occupies its appointed place in the organ, and speaks passably well, tenor C may have its bell inserted with a little pressure; but if found too large to enter the top of the pipe, the tuning-horn applied as in sharpening a note will prepare the way for the bell's insertion. This addition of the bell will approximate the pitch of the note, and very agreeably change its quality. Presuming it is found flat, the bell should be removed, and the body shortened by cutting a piece off. The *bell* should be cut as little as possible; it will probably require no cutting at all, unless the body has been curtailed to such an extent that there is an appreciable disparity between the two parts to be united. This exigency will be avoided if the stop is made to the required pitch. The note being adjusted as the result of repeated cuttings and trials, it has then to be sharpened a mere trifle by a further curtailment, turning to the long flexible *tuning ears*, with which the stop is furnished, for its restoration to the exact

pitch. The entire stop, served after this manner, care being taken to insert the bells no further than is necessary for the temporary preservation of their balance, the two may be soldered together, and the final touch given to the speech, etc.

KERAULOPHONE.—An 8-ft. stop seldom extending below tenor C, of similar form to the Dulciana, viz., cylindrical, the scale also being the same. In tone it resembles the Viola di Gamba, but, although no louder than that stop, it is more pungent and less soothing, this difference being obtained by a *pierced sliding cap* used for tuning purposes. The same quality of tone would result from similarly piercing the body of the pipe, and dispensing with the cap; but as the distance of the puncture from the top of the pipe must remain intact, and as the pipe is not provided with long ears, no means would be left for tuning. This cap is about 4-in. long at 2-ft. C, having a spirally constructed base which turns upon a knob of solder fastened near the top of the pipe. Although fitting closely to the pipe, it is made to work somewhat easily around it; and, according to the direction taken by the angle, it will, upon being made to revolve, rise or sink, and thus flatten or sharpen the note. The place for the hole is one diameter from the top of the cap; in size it will vary between $\frac{1}{2}$-in. at tenor C and $\frac{1}{8}$-in. at the highest note. The notching, cutting up, and wind-hole very slightly exceed the Dulciana; delicacy of treatment is therefore essential. The upper lip will, of course, be beveled.

GEMSHORN, literally Goat-horn.—A soft nasal flue stop of 8 or 4-ft., more frequently the latter. *Fig.* 8, *without the bell*, expresses its form. The scale at 2-ft. C gives $1\frac{3}{8}$-in. for largest diameter, and 1-in. for the smallest. This peculiar musical stop is occasionally made to serve for the Principal in the swell, a plan not to be recommended, as the characteristic softness of the Gemshorn is, as far as practicable, made to yield to the power of the Principal, and, after all, it is but a sorry substitute. Legitimately voiced and of 8-ft. pitch, it becomes an acquisition to the Gt. Organ; or delicately voiced and of 4-ft. pitch, together with a small scale, it combines sweetly with the Stopped Diapason in the Choir Organ or Swell. Its treatment in

voicing obviously depends upon the purpose for which it is selected; in neither case, however, will the mouth exceed $\frac{1}{3}$ in height or be less than $\frac{1}{4}$. Notch as little as possible consistent with clear articulation; size of wind-hole, if of 8-ft. pitch at tenor C, about $\frac{1}{4}$-in. diameter; the same at C C, if of 4-ft. pitch, declining to $\frac{1}{8}$-in. at the upper extremity. Upper lip beveled, cut down to pitch in the ordinary way, and tune by expanding or contracting the aperture at the top.

The foregoing list of Stops embrace all the leading qualities in Diapason work, and in stops possessing individuality of tone, excepting stopped and flute work, which follow in the succeeding chapter. Organ stop nomenclature includes a labyrinth of terms which almost defy selection; many of them, however, stand for stops which in character are merely duplicates of those more modestly designated, every voicer imparting slight deviations of an agreeable or disagreeable nature, according to his taste and ability.

## CHAPTER V.

### VOICING STOPPED AND FLUTE WORK, WOOD AND METAL.

THE department of pipe work, to which our attention is now addressed, is in every respect equal in importance to that which has gone before. The ear has now to encounter sounds of a distinctive quality from those to which it has been accustomed, and the hands have before them manipulation of another kind.

Regarding the selection of stops, preference will be given, as heretofore, to those which from their representative character justly claim priority.

*Bourdon*, or Double Diapason—of 16-ft. tone; a wooden stop with stopped tubes half the length of the Open Diapason, thus producing a 16-ft. tone from an 8-ft. tube. As a manual stop, it is not usually carried below tenor C; size of block at that note, for Chamber Organ, 3-in. wide by $3\frac{3}{4}$-in. deep.

General treatment in voicing as follows:—Cut up $\frac{1}{8}$ with a sharp knife; if the caps are left to be glued on, the face of the pipe will probably be found to extend farther beyond the mouth than is necessary; if so, reduce the surplus to $\frac{1}{8}$-in. This will have the effect of keeping the cap below the level of the block, or languid $\frac{1}{8}$-in. With a fine flat file bevel the edge of the block, until it resembles the edge of a metal languid. The file should be held at such an angle that in working to and fro it just clears the inside of the upper lip. After this, notch the block with a double-edged file, not deeply, making a series of parallel lines from the block's edge to the throat. Clear off the disturbed fibers consequent upon notching, and proceed to prepare the cap. The entire superficial edge of the inner face of the cap being level, a flue has to be made by continuing the cavity right through at that end intended to come nearest the pipe's mouth; until this is done no flue can properly exist. File the edge away, therefore, to the depth of $\frac{1}{16}$-in. at tenor C, testing the evenness of the oper-

ation by placing the cap against any flat surface. Reduce the flue as the higher notes are approached. Before finally securing the cap to the pipe, thoroughly clear the throat of dust and chips, and test the note by blowing into it. If, however, the stopper and joints of the pipe are sound, all knots effectually covered, and the voicing operation cleanly and correctly done, little chance will be left for the pipe yielding a bad note. The addition of *ears* and a *beard* to the lowest octave is sometimes necessary. The bore of the pipe feet is generally such as to ensure more than a sufficiency of wind, therefore plug each foot with wood according to requirements. The stop in question should be subdued in tone.

Stopped Diapason or Gedact, and Lieblich Gedact. —Two 8-ft. stops of similar quality of tone, the latter, as its cognomen implies, being the more delicate. They are sometimes made of wood, the lowest octave always so, but from tenor C metal is more generally used with wooden stoppers. The cylindrical form of the body is preserved throughout its whole length *to the preclusion of any "leaf" at the mouth.* The scales are for the first stop, 2-in. diameter at tenor C; the second, $1\frac{3}{4}$-in. diameter for the same note. The first should contrast with the second by its fullness of tone, for which purpose notch similar to Open Diapason, and cut up nearly $\frac{4}{5}$. A somewhat copious supply of wind must be given. The "Lieblich" requires rather a finer notch, a slightly modified wind-hole, and a mouth $\frac{3}{4}$-in. in height. The mouths in both stops being arched, their *greatest* height has been given. The fault in speech, most likely to be encountered in these stops, is a coughing or whistling noise accompanying the entrance of the note. By cautiously increasing the height of the mouth, the fault will gradually disappear. The bass of either stop being of wood, each require a block at C C, of the following dimensions:—The Gedact, $3\frac{3}{4}$-in. × 3-in.; the "Lieblich," $3\frac{1}{2}$-in. × $2\frac{3}{4}$-in.; this, in either case, will be a 4-ft. pipe, stopped. Voice the same as corresponding notes in Bourdon.

Clarabella.—An 8-ft. stop of wood. The treble is remarkable for its penetrating hollow tone, and the pipes in this portion are open; the bass is of closed pipes, and resembles the lower part of the Stopped Diapason, which,

in fact, usually furnishes the bass for the Clarabella. The open pipes commence at middle C, which is 2-ft. long. The size of block for this note is $1\frac{3}{4}$-in. × $1\frac{3}{8}$-in., and for the highest G, $\frac{1}{2}$-in. × $\frac{3}{8}$-in.

The notches at 2-ft. C should be somewhat fine, and about $\frac{1}{8}$-in. apart; the cap kept below the block rather less than $\frac{1}{8}$-in., and only $\frac{1}{16}$-in. at the top note; the flue rather less than $\frac{1}{16}$-in., diminishing to one-half of this at the highest note. Cut up the mouth $\frac{2}{7}$, and give a plentiful wind-hole. These open pipes have their apertures at the top shaded by thin pieces of flexible metal (sheet-lead), their office being to *tune* the notes to which they are fixed. Previous to fitting these metal shades, however, the pipes must be cut a quarter of a tone sharp with a dovetail saw. The metal shades should be same width as the back of the pipe, and exceed its *depth* by $\frac{1}{2}$-in. In order to fix them, a vertical saw-cut is made in the back, parallel with the front of the pipe, for the reception of the shade, which, of course, should fit firmly. As before hinted, the throats should be carefully cleared of chips and dust, and each note tested by blowing into it before glueing on the cap. Feebleness of tone may often be mitigated by widening the flue, or withdrawing some of the plugging. The two remaining octaves below will receive similar treatment to that applied to the Stopped Diapason Bass; the same scale serving for the present purpose.

Harmonic Flute.—A 4-ft. stop of remarkably fine quality. It is at once rich, full and eminently flutey. The material used in its manufacture is metal from tenor C upwards; should it extend to C C, stopped wood pipes would compose the lowest octave. Although this stop, in common with all harmonic stops, is usually placed over a heavy pressure of wind, examples exist voiced to the present pressure ($2\frac{1}{2}$-in.) of sufficient merit to warrant recommendation.

The pipes from middle C upwards are of double length, and are made to speak the octave above by a process to be described. Tenor C, 2-ft. long, and $1\frac{3}{4}$-in. diameter; middle C, also 2-ft. long, and $1\frac{1}{4}$-in.; foot C, $\frac{7}{8}$-in.; and 6-in. C, $\frac{9}{16}$-in. General treatment in voicing as follows:—Notch a trifle finer than Open Diapason. Cut up mouth $\frac{1}{3}$

throughout, and slightly arch the same. The upper lip somewhat convex in furtherance of a flutey tone. The wind-holes of both tenor and middle C, ¼-in. diameter. Two large pin-holes midway between the two extremities of the *body* should now be made with a pointed knife, one on either side of the pipe. Prepared thus far, the stop may be lodged in the Organ, and if found tolerably correct in speech and equality, it may be cut down, leaving it a little flat to pitch. It is advisable now to complete the harmonic portion of the stop, as the lower octave is more manageable and presents less difficulty in the matter of matching the harmonic with the non-harmonic portion. If, upon trial, the former portion is found disinclined to speak the octave, depress the languids a little. In attending to the speech of the pipes, the fault most likely to present itself is a dual disposition to emit either the *fundamental* note, or else its *twelfth*. The first may arise from an overcut mouth; this would be the case when together with this fault the wind-hole is too large to admit of any further expansion. If this be the case, a cure may possibly be effected by either depressing the languid slightly, or by making the lower lip a little concave, or by both. On the other hand, should the tendency lean toward the production of the Twelfth, the height of the mouth may be cautiously increased; or, if the note is already too loud, the reduction of the wind-hole will have the double effect of softening the note and obviating this fault. The final touch having been given to equality, uniformity of tone, and pitch, the tenor octave may next engage our attention.

The aim must now be to match this octave with the harmonic portion. To this end work downwards from the highest to the lowest note of the tenor octave, beginning with the B below middle C. If this note is found to be *thinner* in quality, and at the same time louder than the harmonic C immediately above it, reduce wind-hole; if still it remains thinner, cut up higher. The effect of cutting up higher, or of reducing the wind-hole, will be to thicken the tone. In this manner, uniformity may be obtained throughout the octave, and the "break" at middle C rendered almost imperceptible. The adjustment of the pitch of this octave will complete the stop.

Clarionet Flute.—When two flutes are admissible, this one forms an agreeable contrast with the preceding one. It is literally a somewhat reedy flute of 4-ft. pitch, composed of metal from tenor C, with wooden stoppers, which are perforated. The scale may be the same as used for the Lieblich Gedact, to which it is precisely similar in construction. The only difference in the voicing consists in keeping the mouth a trifle lower. The hole in the stoppers should not be small. The stopped pipes are best discontinued at the commencement of the uppermost octave, owing to the weakness peculiar to such small stopped pipes. Open pipes of Principal scale should be substituted. No remarkable break will be perceptible if this octave is cut up $\frac{2}{5}$, and the upper lip rendered convex by raising it from the inside with one of the iron wires. They must be winded to match those below in strength.

It is not desirable in so unpretentious a work as this to enumerate more manual flue stops than the foregoing. The scope taken is only intended to embrace the requirements of the amateurs' Chamber Organ, a fact already intimated. It is hoped, therefore, that a sufficient variety has been suggested. (*Reed* stops, so far as their care and management is concerned, are reserved for a subsequent chapter.) True, other stops suggest themselves with some importunity for chamber purposes. Foremost among them, perhaps, stands the beautiful *Celeste*, with its mysterious undulating effect. It consists simply of two Dulcianas, one being tuned a little sharp to the other. Then, again, some would deem it a sin to omit the tripping *Piccolo* or *Flautino*, with its bright pungent tone ; and, by the way, a good stop of this kind may be produced from a Fifteenth, if cut up $\frac{3}{5}$, and rendered flutey by making the upper lip convex. But with this we must cease.

## CHAPTER VI.

### PEDAL STOPS, WOOD AND METAL.—FRONTS.

It need hardly be said that the proportion of the pedal stops for Chamber Organ use is small. In many cases the Bourdon alone will suffice. Chamber Organs, however, are fast assuming such an imposing magnitude that a plurality of pedal stops is becoming indispensable. A Bourdon, scaled and voiced to balance the maximum power of one of these larger instruments, will be found of too great volume for the softer tones of the same instrument; and yet it is desirable that the 16-ft. bass be preserved in each case. To meet this want, the addition of a second Bourdon, differing in scale from the first, is recommended wherever space permits of its introduction. If we add to this a Violoncello, by the way of variety, our list of pedal stops is complete.

We shall now proceed to give suitable scales for the above, with directions for voicing:

Bourdon (1).—A Stopped Diapason of 16-ft. tone. The lowest note gives the C C C from a tube 8-ft. long. The scale dimensions for this note are (inside) $6\frac{5}{8}$-in. deep, by $5\frac{1}{8}$-in. wide, decreasing in this stop, and likewise the next, to half the size at the fifteenth note. Assuming a compass of thirty notes, C C C to F, the general treatment in voicing will be as follows:—Depth of notch for the lowest note, $\frac{3}{32}$-in.; distance apart, $\frac{3}{8}$-in.; flue, $\frac{1}{8}$-in.; mouth, cut up $\frac{1}{3}$. Depth of notch for the highest note, rather under $\frac{1}{16}$-in.; distance apart $\frac{1}{8}$-in.; flue, $\frac{1}{16}$-in.; mouth, cut up $\frac{1}{3}$. As the bore of the feet generally exceeds the requirements of the pipes, more or less wood plugging will serve to remove any inequalities in tone. Respecting speech, it is only necessary to observe, that if the throats are well cleared of loose chips, etc., the joints and stoppers perfectly sound, and all woolly fibers removed from the wind-way, this stop ought to speak readily and well.

Bourdon (2).—Scale for C C C (inside) 5-in. deep by 3½-in. wide, graduated as in Bourdon (1). The voicing operations of this stop are simply a modification of those applied to the preceding one, care being taken to keep it more subdued by plugging.

Violoncello.—A pleasing, crisp-tone metal stop, intended to imitate the orchestral instrument bearing that name. The metal most suited to the production of the required tone is either tin or unannealed zinc, preference being given to the first. Ordinary "metal" is calculated to destroy that fresh crisp tone, without which this stop must be pronounced a failure.

The following scale is recommended:—8-ft. C, 4¾-in. diameter; 4-ft. C, 2⅝-in.; 2-ft. C, 1⅜-in. Length of foot not less than 18-in.

Voice as follows:—A fine notch, especially that of the lip; mouth cut up ⅔; the upper lip with its edge beveled; flue rather narrow.

The method for correcting faults in speech is identical with that adopted for the other metal stops. Provision for tuning will be made by first leaving every note flat to pitch, and then forming a tongue at the top of the pipe from two vertical saw-cuts parallel to each other and about 1-in. apart at C C. The length of the tongues will depend on the degree of flatness to which the pipes are left. This plan for tuning supposes the stop to be composed entirely of "inside" pipes. If the material adopted for use in this stop is zinc, lead tongues should take the place of the zinc ones.

We come now to consider the front pipes. First, as to the material adopted. Pure tin, burnished, is imposing in the extreme, but is, of course, very costly. Spotted metal, if of the best quality, is at once handsome and characteristic. If, however, it is intended to decorate the front, zinc may very well be used by observing the following restrictions:—That it be of good substance; that the speaking pipes be provided with "metal" mouths, and that the use of zinc be discontinued at the 4-ft. C. for beyond that note the tone becomes impoverished, and if the front forms, as it generally does, the basses of some of the manual stops, the use of zinc beyond the prescribed limit might prove

disastrous. It is pretty well known that the disagreement existing between the pitch of a note yielded from a front pipe, and its length, is due to the presence of holes cut in the back of them, which adjust the column of air without altering the length of the pipe. Instead of holes, one long continuous aperture may sometimes be seen; this last is the most commendable plan, owing to the fact that less interruption is offered to the vibrating column of air within the pipe. This brings us to consider the position of the aperture, and for this purpose a rod should be set out in obedience to the following directions:—First obtain a strip of deal ½-in. thick, about 2-in. wide, and 8-ft. long. Having decided from which end the measurements shall start, mark off the following lengths, adding their corresponding notes:

| | | | |
|---|---|---|---|
| C C | = 7-ft. 11-in | Gamut G | = 5-ft. 3-in. |
| C C♯ | = 7-ft. 6-in. | " G♯ | = 5-ft. ½-in. |
| D D | = 7-ft. 1-in. | " A | = 4-ft. 8½-in. |
| D D♯ | = 6-ft. 8-in. | " A♯ | = 4-ft. 5-in. |
| E E | = 6-ft. 3-in. | " B | = 4-ft. 2-in. |
| F F | = 5-ft. 11-in. | Tenor C | = 3-ft. 11½-in. |
| F F♯ | = 5-ft. 9½-in. | | |

The second octave may be obtained by dividing the above lengths by two. Scale, as well as pitch, affects the length of a pipe; where the scale is smallest, the pipes will be longest, and, of course, *vice versa*. Reed stops are affected in exactly the opposite way.

As all the scales given in this work are small, and the rod is intended for a medium scale, the lengths must be left rather full. The method for cutting the backs of front pipes, is to lay the pipe upon its face in two semi-circular pads (to prevent defacement); and, supposing the note is D D, with a body 8-ft. long, to place the rod at the seam uniting body to foot. Between D D and D D♯ on the rod, and ⅖ of the distance nearest the latter note, make a mark on the pipe. This must only be considered approximate. At this mark make a transverse saw-cut ⅖ of the diameter of the pipe in length, and so that the seam of the pipe may equally bisect it. A similar cut must then be made within 2 or 3-in. of the top of the pipe (3-in. where the surplus length is plentiful), and the two cuts joined by two

parallel lines. A metal-worker's "hook" made to traverse these two lines several times will set the pieces free. The note should still be found flat, and be adjusted to pitch by cutting a tongue at the base of the aperture about 1 in. wide. This will serve for tuning.

The whole operation should be performed with care, inclining to the flat side, as another cut can easily be made if found too flat; and the pitch of the pipe should always be tried before introducing the tongue. A 3-in. tongue is a fair length, and a close approximation to this may be obtained by leaving the gamut G about three beats per second flat before its introduction. The Gt. Principal is the assumed standard of pitch. The same degree of flatness in notes above the one cited for an example, will produce beats increasing in rapidity as the notes become more acute. An octave in the direction indicated doubles the number. Fiddle G, therefore, to be as flat as gamut G, would need to beat six times per second against its corresponding note in the Principal.

## CHAPTER VII.

### THE MANAGEMENT OF REED STOPS, AND TUNING IN GENERAL.

THE amateur is not advised to attempt to voice reeds. Besides the intricacy of the work itself, its proper execution entails an expensive "plant." Moreover, *bad* reeds are an abomination rather above ordinary nuisances, and the unpracticed hand would too readily discover the work to be extremely exacting. Finished voicing in either department is the result of long and steady practice under skilled guidance; but in reference to reed work this truth acquires additional force.

The question of *managing* tongued stops, however, is an important one, from their susceptibility to derangement and the inconvenience arising therefrom. The provincial organist would hesitate to call in a professional man for every slight casualty; the town organist might be similarly placed from the builder being a provincial man. To obviate the need of such a step, when the defect is superficial, is, in part, the object of the following hints:—

First, familiarise yourself with the construction of a reed pipe. Examine it in detail, commencing with the *boot*, which rests upon the soundboard. Into this a *block* is inserted, fitting firmly; to this block and surmounting it is, in the smaller pipes, soldered the tube. The larger tubes drop into a *socket*, soldered to the top of the block. The tube has two holes in it; the largest one receives the *reed*, the smallest one the *tuning-wire* or *spring*. The reed is a small brass cylinder, one side being flattened for the reception of the *tongue*, which covers an aperture on the flattened tube of the reed, and is secured by a wooden wedge. The tuning-wire referred to presses upon the tongue, and, acting as it is raised or depressed, thereby lengthening or shortening the tongue, is the pitch flattened or sharpened. To facilitate this operation, the top of the tuning-wire is hooked to receive the upward or downward stroke of the

tuning-knife. Both the tubes and the cylindrical brass reeds are of various kinds. The first include the cylinder, the inverted cone, and the inverted cone surmounted by a bell, similar to that employed in the Viola di Gamba. The various kinds of reeds comprise the *striking* and the *free* reed. The striking again includes the *open* and *closed* reeds; the first are open from end to end, the second but partially open. The openings differ in size according as more or less power is required; but in all cases the closed reed imparts *smoothness* of tone, while the open reed gives that *clang* peculiar to the Trumpet and Clarion. Another form of reed is the *free reed*, used for the Cor Anglais, but rarely met with in this country; some have been imported from France.

Reed stops are easily upset. A particle of dirt making its way between the tongue and the reed may cause a deviation of pitch, impurity of tone, or even produce dumbness. The channels afforded for such erratic particles are various. They may come from beneath the bellows, following the enforced current of air, or enter by the tube; or again, the unfaced leather within the bellows or windchest may, especially when new, give off whiting or fluff. By whatever means the dirt has arrived, it should be carefully removed in the following manner:—First, take out the tube, if the block is soldered to it; if not, raise the tube with one hand and take out the block with the other; next, draw the tuning-wire close down to the edge; now pass a piece of thin note-paper between the tongue and the reed, so directing the course of the paper that the dirt may not be jammed down at the root of the tongue. This process carefully wrought will often restore a note to its primitive state. A too common practice prevails amongst the uninformed, of driving the tuning-wire up and down, hoping thereby to improve the note; the very opposite is the most natural as well as the most usual consequence. The tuning-wire is repeatedly made to ride over the intruding substance until a corresponding indentation appears in the tongue, to its utter ruin. Other results may follow this unwise practice, which, although not fatal in the absence of dirt, are destructive to the "set" of the tongue.

The reed stops most susceptible to derangement from

dirt are those for which a closed reed is necessarily used; these present a larger surface for the lodgment of dust.

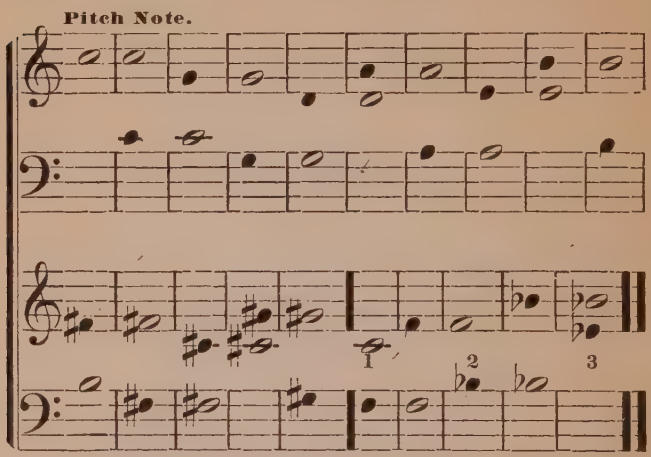
Inequality in the volume of sound yielded from a series of pipes forming a reed stop must be expected prior to finishing in the Organ. This may be due to their closer proximity, for the space afforded to a stop in the Organ usually differs in capacity from that which the stop occupied during the process of voicing. Thus it often happens that when the stop is "put in" each pipe is more or less shaded by its neighbor, and rendered flat. To obviate this by the tuning-wire alone, would be to subdue the power of the note so operated upon; therefore, carefully reduce the length of those pipes so affected, and then correct the pitch by the tuning-wire.

To remove inequality in reed stops furnished with metal shades, like the Oboe, for example, the power of a note will be increased by opening the shade, and subdued by closing it; the spring must then be used for correcting the pitch.

Faults in speech, such as slowness, roughness, want of purity, etc., if unimproved by either of the simple means above indicated, had better be left for the tuner. The preservation of reeds is furthered by constructing above them a covering of wood or metal (zinc), by which falling dust, etc., may, to some extent, be excluded. The same object is attained by mitering the top of the pipe to a right-angle, and so excluding any descending substance.

In an over-heated atmosphere, the wedges which secure the tongues in their places are liable to shrink and drop on to the sound-board pallets. The mischief, in such a case, is obviously twofold; for the tongue is left insecure, and the pallet, in all probability, becomes fixed open, thus causing a "ciphering." Hence arises the advantage of a uniform temperature, conducive alike to the good of the mechanism and to unisonance in both reed and flute stops; the plan, therefore, of opening the "Swell" shutters for an *hour or so*, to equalize the temperature before using the Organ, is a commendable one. To *always* leave the "Swell" open when the Organ is not being used, is to admit the dust, and the possibility of warping the shutters, besides placing an undue strain upon the pins which carry them.

We have now to consider how best the instrument may be tuned; and, first (having disposed of "pitch" elsewhere), as to *temperament*. The prevailing system of *equal temperament*, by which each sound comprised in the octave, may be employed as the root of its own major or minor key, by which, again, every interval employed in harmony is made tolerable to the ear, needs no recommendation. A scheme, combining simplicity with accuracy, is here submitted:—




It will be noticed that the above scheme includes but two intervals, viz., the octave and fifth. The white notes indicate those tuned, the black notes those *to be* tuned. All the octaves must be perfect, and the fifths somewhat flatter than perfect. To temper the fifths, first tune them perfect, and then flatten them so that a succession of *slow beats* or waves can be distinctly heard following each other. In this way should the first G in the scheme be tuned to the C immediately beneath it, and so on with the rest until the last three are reached. These are respectively numbered 1, 2 and 3; and here the process must be reversed in the following manner:—First obtain purity, and then *sharpen* the black notes in the scheme in exactly the same

degree as the upper notes of the former fifths were depressed, thereby still contracting, diminishing, or flattening the interval. This process, called "laying the bearings," should be occasionally interrupted by a test cord including only the notes tuned; any false tempering can thus be checked. The whole process will have to be repeated very many times (if attempted by a novice) before anything like a successful result is obtained; after which, proceed to tune the remaining notes above and below the limits of the scheme in the relation of octaves to those adjusted. Other schemes are in general use, but they all have one common result. Their leading features may thus be summarized:—All octaves perfect; major thirds *sharper* than perfect; minor thirds *flatter* than perfect; fifths *flatter* than perfect, and fourths sharper by the same quantity. The deviation from purity being small in every case, the consonancy of the intervals is not affected to any disagreeable extent.

The application of this system of tuning to the Organ requires that the *bearings* be laid upon the Principal with great accuracy, as all the other stops, on whatever manual, are tuned to it. To ascertain in which direction a note deviates from the truth, slightly shade the top of the pipe, if an open one. The stops to follow the tuning of the Principal are those situated farthest from the tuner; the reeds are always readily got at, and should be left until the very last. In reaching over stops already tuned, in order to get at others requiring tuning, finished work is rendered imperfect, as it is impossible to avoid touching the pipes.

Different means are employed for tuning the various stops. All open-flue stops not provided with long ears nor slides will be sharpened by expanding the aperture at the top of the pipe, and flattened by contracting it. The tuning-horn, inserted point downwards, will effect the first, whilst forcing the cavity of the cone on the summit of the pipe will accomplish the second. Those stops having long ears are tuned by them—closing them to depress the pitch, and the reverse for sharpening. As the process of sharpening is invariably opposed to that of flattening, it will in future be superfluous to

indicate more than one way. Stops provided with a sliding cap are flattened by raising the slide. Stopped pipes of wood or metal are sharpened by depressing the stoppers. The uppermost octave of stopped registers, as well as stops of a soft tone, are best tuned to their own octaves. The Clarabella having metal shades, is sharpened by raising them. The front pipes have their tuning-tongues, which can be lengthened at pleasure with a saw.

The delicate intonation of such stops as the Dulciana, Keraulophon, and others, renders it necessary that they should be tuned to a softer stop than the Principal; something in the "Lieblich" line will meet this want. Slotted stops, such as the Violin Diapason and Gamba, are tuned by the tongue cut in them. The note is sharpened by increasing the length of the slot.

The *mutation* stops, of whatever interval or intervals, are always tuned perfect. In the compound stops of several ranks, one rank must be done at the time, silencing the others by the insertion of mops made for the purpose. Where each rank has a separate slide, this mode of procedure can be dispensed with and the slides made use of.

Having finished the manual *flue* work, the pedal stops can next be done. The Bourdon is adjusted by the stoppers, which need a hammer for their depression. If the ear can not determine in which direction the note errs, the mouth of the pipe should be shaded; should this improve matters, the stopper is already in too far, and must be raised, if possible, by forcing the handle of the stopper to and fro.

The open-pedal pipes, if of wood, may be provided with a wooden shade for tuning; or, let a vertical slot be made in one side, and at the top of the pipe, 9-in. long and 1¼-in. wide at 8-ft. C; this covered by a piece of wood of suitable width, and turning upon a screw inserted at its lowest extremity, will sharpen or flatten the note according as it is made to disclose or close the slot. These slips of wood need to be firmly screwed to the side of the pipe, as any looseness will produce a chattering sound when the stop is in use. The open metal pedal pipes can be tuned by a tongue cut at the top; and those pedal

stops of 16-ft. pitch are best tuned to an 8-ft. stop on the manual.

The reeds have yet to be tuned. The rest of the Organ (absolutely inclusive) having been tuned, and all possibility of disturbing the reeds being removed, their final adjustment may follow. Where they are two, three, or more deep a long tuning-knife becomes requisite. This instrument is merely a flat strip of iron, rather under $\frac{1}{8}$-in. thick, from 1 to 2-ft. in length, and about $\frac{5}{8}$-in. wide, excepting one end, which, for the length of 2-in., is about $\frac{7}{8}$-in. wide. This widest part has its shortest edge "feathered" or beveled. If, however, there is but one reed stop on the sound-board, any flat instrument will serve to tune it. When the tuning-knife is in actual use, the tuning-wire should be moved as gradually as possible, the slightest change in its position sufficing to vary the pitch largely. To sharpen the note, gently tap the wire downward; and, in flattening the note, the crook at the top of the wire will receive an upward stroke from the feathered edge of the tuning-knife. These remarks on tuning reeds are intended to supplement those already given on their management.

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